 **Investigation: Periodicity and Relationships**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Core: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Background:*** A periodic event is one that occurs time after time in a regular, predictable way. If you have a table of repeating events, you can use it to predict what might be true in the future. Dmitri Mendeleev published the first periodic table in 1869. This is a definite example of periodicity, hence, its name. He showed that when the elements were ordered according to atomic weight, a pattern resulted where similar properties for elements recurred periodically.

In our world, we seek to find relationships and patterns to make sense of things around us. Humans constantly try to impose order on nature. Some refer to it as a simple math equation:

**ORDER = UNDERSTANDING**

Your investigation will dig deeper into the relationship among the elements’ atomic numbers, radii and positions in the periodic table.

***VOCABULARY:***

* **Atomic radius**: An atom’s atomic radius is the distance from the center of the nucleus to the edge of the atom. The radii are so small that a very small metric unit called a “picometer” is used for the measure.
* **Picometer**: Metric unit to measure atomic radii. A picometer (pm) is one trillionth of a meter!

***YOUR TASK:*** You create an orderly chart that includes the name and symbol of the elements with atomic numbers 3 - 38. Your chart needs to include the elements’ names, symbols, atomic numbers and atomic radii (in pm). You will then plot the atomic radii of these elements on a graph and analyze your graph for repeated patterns, answering guided questions. Finally, you will explain the conclusions you draw from this analysis.

**Helpful Hints:**

1. *Make an organized chart of the elements and gather the atomic radius information. You will find that the atomic radii is NOT in order according to the order of the atomic numbers. That is why you are going to graph the atomic radii and look for patterns.*
2. *Make another organized chart, only this time put the elements in order according to their atomic radii from smallest to largest. (Aluminum, Al, atomic number 13 will be the first element in your chart because it has the smallest atomic radius – 143pm)*
3. *Finally, plot the atomic radii on a graph. Label the horizontal axis of your graph with the atomic numbers, 0-38 and label the vertical axis with numbers 0-280, representing atomic radii. Decide on intervals for your graph that will make a clear visual – one that can be seen and read easily. Larger is better! This can be done by hand or digitally.*

***WEBSITE FOR INFORMATION***

Click here for information on atomic radii: <http://periodictable.com/Properties/A/AtomicRadius.v.html>

Be neat and, of course, ORDERLY! Remember you must create CHARTS AND A GRAPH!

Put all of this together into a visual for presentation. Use the following guided questions to present your analysis in a logical, clear and detailed way…All of these questions should be answered WITHIN your presentation.

1. Explain the patterns that you see in the shape of your graph. Be detailed in this explanation. Include peaks and dips.
2. What family is represented by the high peaks in your graph?
3. What family is represented by the low points in your graph?
4. What family is represented by the smaller peaks JUST BEFORE the higher peaks?
5. What do you notice about the radii of the elements at the high peaks as you move from left to right on your graph?
6. Look at your periodic table and find the element that represents each high peak. Where does each high peak begin in the periodic table?
7. What happens to the radii of the elements between the two highest peaks AND what does each of these groups of elements represent?
8. How can a graph such as this one that you created help to predict the properties of elements that have not been discovered yet?
9. How do the radii of metals in each period compare with the radii of non-metals in that period?
10. \*\*What is your final conclusion overall in reference to the “ORDER” of nature’s elements? Justify any conclusions that you present.